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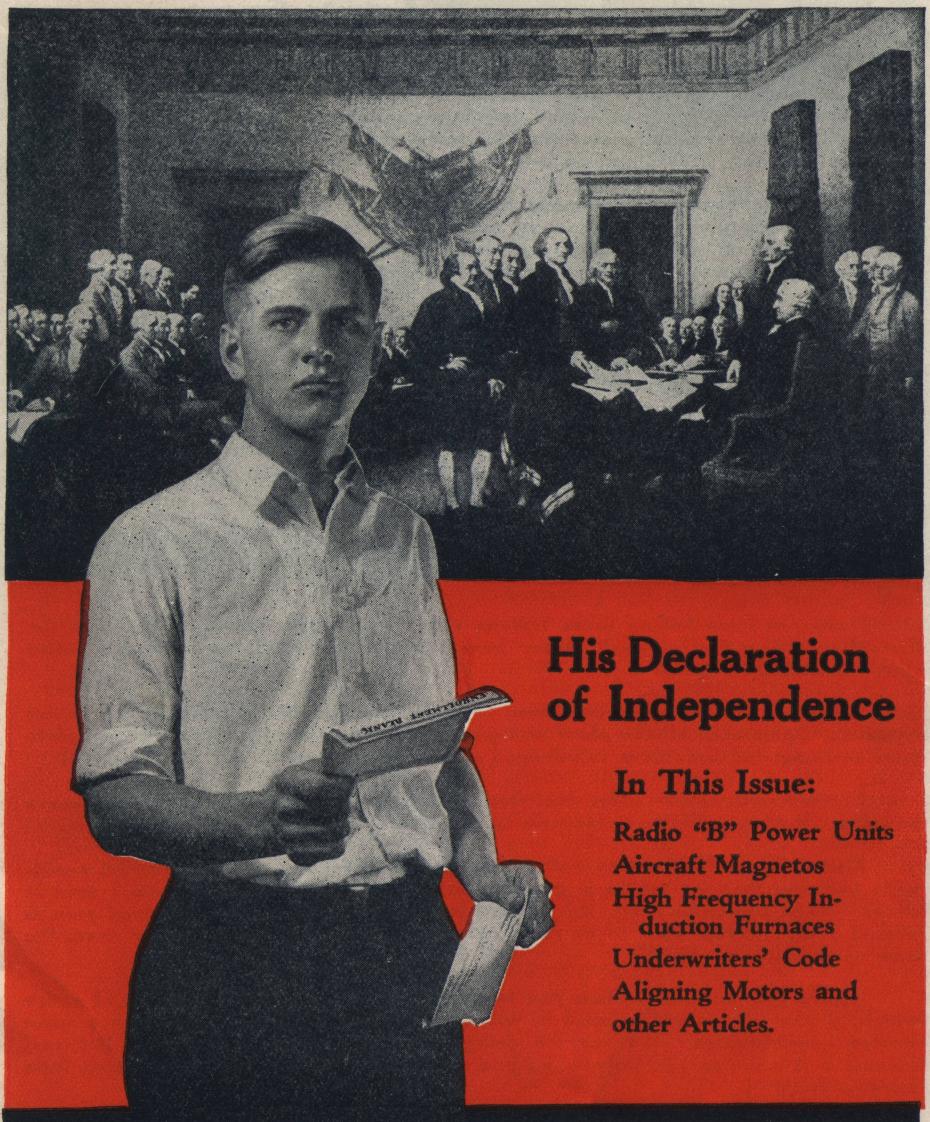


His Declaration of Independence

In This Issue:

Radio "B" Power Units
Aircraft Magnetos
High Frequency Induction Furnaces
Underwriters' Code
Aligning Motors and other Articles.

Now!

THERE is a time for getting ready for your future. There is a time for training yourself to fill a bigger and better position than the one you have. There is a time for grasping the wonderful opportunities that Electricity offers you.

And that time is — NOW!

The man who says, "I'll study tomorrow" never studies at all. The woods are full of men who put things off—who dawdle around when they should be doing real work and making real progress—but the world needs men who will take off their coats, roll up their sleeves and do it—NOW!

George Stephenson, the famous English railroad builder, designer of the first multitubular fire-tube locomotive and many other famous devices, was doing the commonest kind of labor in the mines when he saw his first steam engine. His enthusiasm was aroused. Instantly he wanted to know more about it. But he couldn't even read. This handicap would have stopped ninety-nine men out of a hundred—they would have said, "Oh well, I'll study up on engines when I learn to read." But Stephenson started in to learn to read that very day. In a few months he was able to study the books on engines that laid the foundation for his future. He became rich, successful, celebrated, because he knew the value of "NOW."

Do you feel that with a knowledge of Electricity you could land a real job—actually be "somebody" in your town—live on Easy Street with an honest-to-goodness salary, instead of struggling along on poor pay? Then get that knowledge NOW!

Do you know of big, important "bossing" jobs you could get, of promotions that would go to you instead of to the other fellow, if you were properly trained? Then go after your training NOW!

Have you been letting those lessons slide, promising yourself to do them the first chance you had? You'll never have more time—you'll never find a better time—than NOW!

Shake off that summer let-down. Forget the idea of laying off until cooler weather. Remember all the plans and good resolutions you have made to complete your training and become a full-fledged electrical man—and GET BUSY NOW!

Not tomorrow night. Not next week. Not the next time you have a few spare minutes. But right NOW, is the time to get after those lessons, my friends—NOW!

Electricity can't afford to wait for the put-it-off fellow. This wonderful world-wide business that we are in is growing so fast that it must have trained men at once. When the call comes, the trained man gets the job—the untrained man is passed over. If you want to be ready when opportunity knocks at your door, the time to prepare is—NOW!

Before you know it—when you least expect it—the golden chance will arrive which, if you are trained to seize it, will lead you to fortune. Wasted hours mean wasted opportunities. It's easy to delay—it's easy to make excuses. But real success will come to you only when you realize the importance of that great little word—"NOW"!

L. L. COOKE.

The New High Frequency Induction FURNACE

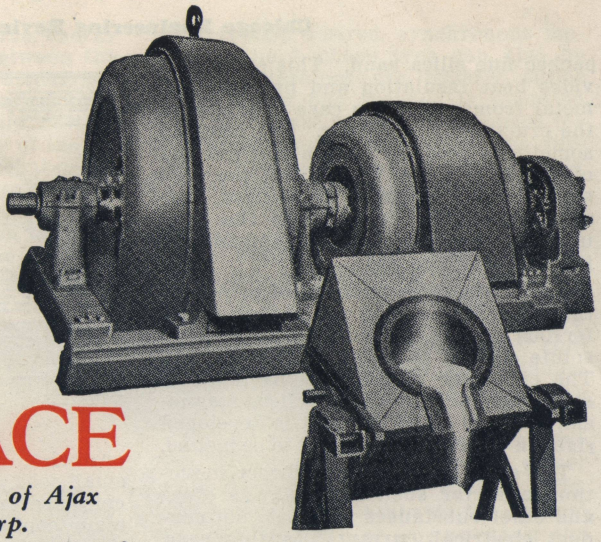


Illustration by Courtesy of Ajax Electrothermic Corp.

AN induction furnace is a type of furnace operating on the principle of an electric transformer. The metal to be melted is held in a ring shaped crucible or hearth, the core of the transformer passing through the hole in the ring, so that the bath forms a one turn or a short circuited secondary circuit. Consequently, the bath will carry a high current at a low voltage and will be heated in the same manner as in the resistance type of furnace. Recently, after a considerable amount of development work, the Ajax Electrothermic Corporation of Trenton, N. J. perfected a type of induction furnace known as a high frequency type. These new high frequency furnaces will range in capacity from one ounce to one ton or more.

The large furnaces use a motor-generator set for their source of power, while the smaller sizes, such as those used in experimental laboratories or for small production or research work, receive their power from frequency converters.

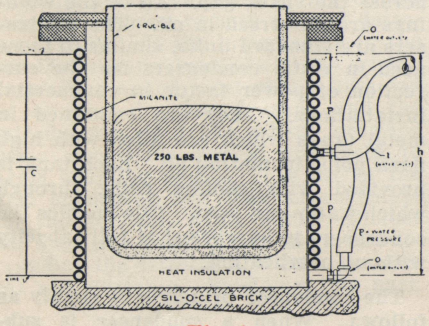


Fig. 1

These furnaces are now being used in a wide field—for producing special alloys,—such as Permalloy; in the production of high grade tool steel; for the material used in high grade fountain pen points; in the production of alloys containing gold, platinum and other precious metals,—because of the uniform composition of the material produced and because it is free from impurities, such as carbon which in the case of steel is considered as a defect.

The principle of the high frequency furnace is that of an air transformer whose primary is the furnace coil and whose secondary is the material to be melted or the conducting crucible or container of the metal. The primary is merely a coil of copper tubing, wound around the metal container, through which water is passed for cooling purposes. Fig. 1 shows the cross section of a simple, high frequency furnace. If a high frequency current is applied to the terminals of the coil, all the space inside the coil is subjected to a rapidly alternating electro magnetic field. If you should place an electrical conductor in this magnetic field, you would have current induced in it. These induced currents cause rapid and efficient heating.

In Fig. 1 the inductor of copper tubing I is shown with its water connection, so that water flows through the inductor coil, entering at the middle point (i) and leaving by the outlet (00) at each end of the coil. You will note that directly underneath the copper tubing, there is a sheet of insulating material and between this insulating material and the container, there is a layer of

packed fine silica sand. This sand provides heat insulation and prevents the metal from spilling in case of a leak in the crucible or container. The crucible sometimes used for carbon-free melting of the iron alloys is made of moulded silica sand. When it is desired, this crucible can be omitted and the sand used for both the container and for the insulation of the heat.

There are three methods of providing the heat. First, by direct induction for ferrous metals, particularly where absolute control of the carbon is desired. The container in this case is made of some substance such as silica, magnesia, etc., and all of the heat is developed right in the charge of metal to be melted.

The second method is indirect induction, used for such materials as glass and other substances which do not conduct electrical current. In this case, the material to be heated or melted is placed in a crucible made of a conducting material such as graphite or carbon. Almost all of the heat in this case is generated in the crucible itself and given to the metal by conduction and radiation.

Another method of heating in these furnaces is known as semi-direct induction melting, in cases where nickel or similar metals of high resistivity are to be melted. In such cases, the crucible is only partially conducting, as one made of clay-graphite. In this type of equipment the metal heats at the start by direct induction. This transmits enough heat to the crucible to make it hot, thus increasing the electrical conductivity of the crucible. The crucible will then continue to be heated by induction, rather than by radiation

Fig. 2 shows a furnace with the dimensions given, indicating in what small sizes, they can be built for laboratories, experimental work and for small jobs. In this type of furnace, the coils are exposed, because the coils remain cool enough to be touched with the bare hand at any time, even during the entire melting operation. The furnace can be lifted and its contents poured without any dirt or smoke, by one operator. This makes it portable and very efficient in handling.

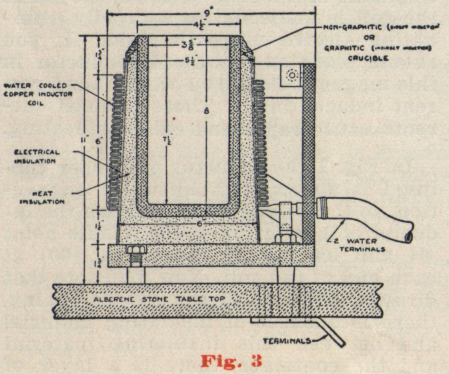


Fig. 3

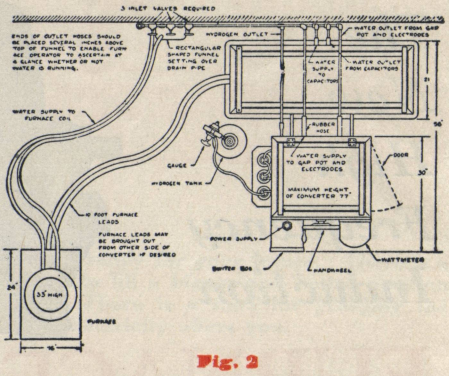


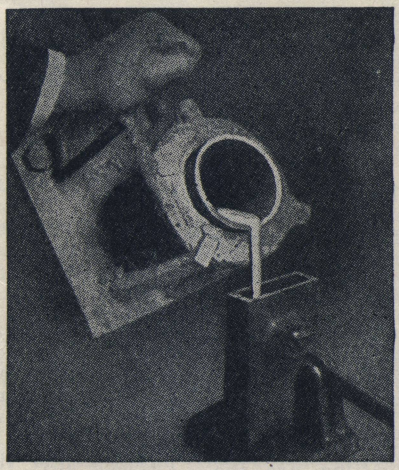
Fig. 2

In order to obtain high frequency alternating current, it is necessary to use for the small furnaces, static converters. These converters consist of condensers, transformers and a spark gap. For the larger power units, necessary in the large commercial furnaces, a motor generator set, ranging in capacity from 20KW to 1500 KW is furnished.

The high frequency converter changes alternating current of any commercial frequency to high frequency currents suitable for operating these furnaces. Each converter consists of three pieces of apparatus; a reactive transformer, a bank of condensers and a specially designed spark gap. The transformer is used to transform the line voltage to a value sufficiently high to charge the condensers and cause them to discharge across the spark gap. All of the windings are immersed in oil. The condensers are standard units, similar to those used in static condensers for the correction of power factor in commercial installations. They are contained in metal tanks which are filled with high flash point insulating oil. Each tank is provided with cooling coils, through which water can pass. This enables the condensers to be worked at full capacity without overheating.

The condenser principle is simply as follows. When a condenser is sub-

jected to an electro motive force, energy is stored in the dielectric between the plates. If this energy be discharged across the spark gap connected to a suitable circuit, current would flow in this circuit, but the frequency of the alternations would no longer be that of the line current supplied to the primary of the transformer, but it will have a much greater value, depending upon the constant of the circuit. In the 35 KVA converter the frequency varies between 5,000 cycles and 50,000 cycles, depending upon the size and type of the furnace coils used. Variation of power is taken care of accurately by increasing and decreasing the sparking distance between the electrodes and the mercury bath in which the electrodes are placed. Fig. 3 shows the plan and size of a 35 KVA converter and furnace with the necessary piping and connections.



A Small Portable Furnace Used By Jewellers and Workers in Precious Metals.

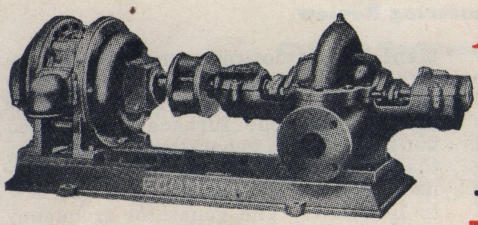
For the large commercial units, a motor generator set for developing the high frequency current is necessary. The motors used are usually of the induction type, 3 phase; or where power factor correction in the plant is also desired, synchronous motors of the 3 phase type can also be used. Generators are usually single phase where one furnace is operated but 2 or 3 phase generators are used for the installation of more than one furnace. The output ranges from 20 KW to 1500 KW. The generator frequency varying from 720 to 3,500 cycles.

The generators have their voltage controlled by adjusting the field resistance of the exciter set. Where these generators are connected to the induction coils of the large furnace, it is necessary to have some sort of power factor control. Fig. 4 shows the method of connecting the generator to the furnace and providing for power factor control by variable condensers connected in parallel across the line. They are so arranged that when the power factor of the generator is lagging, or leading, one or more condensers are cut in or out. This enables full load to be carried by the generator, without overheating due to poor power factor control.

CAUSES OF HUM IN A. C. RADIO SETS

A common and troublesome cause of hum in sets employing a.c. tubes is due to coupling in the parts of the circuit that are common to both r.f. and detector circuits. If the instruments in the set are properly located and the wiring carefully planned, most of this hum can be eliminated. Cabled leads and the introduction of loops where crowded parts complicate wiring also help to avoid coupling effects. The use of the grid condenser and leak arrangement for the detector, while highly efficient and sensitive, often makes the area surrounding the detector portion very critical and unstable. Shielding this part, or changing the detector to the grid-bias method may also remedy the trouble. If these changes do not eliminate the coupling that causes the hum, a simple and very effective method is to insert a .1-meg. fixed resistor in the grid-return lead between the F-terminal of the r.f. transformer secondary of the detector circuit and the resistor which provides the grid bias for the r.f. and detector circuits. A .1 mfd. by-pass condenser should then be connected between the F-terminal of the transformer mentioned and the cathode terminal of the detector tube.

—Courtesy of Pop. Mech. Magazine.



Practical Method of Aligning MOTORS

By Member L. L. Cooke Engineering Staff

IN LOCATING a motor which is to be belted to a shaft there should be a proper distance between the motor and the shaft. This distance should neither be too small nor too great. A rule for determining the distance which will give best results is as follows: Make the distance between the pulley centers 4 or 5 times the sum of the diameters of the two pulleys. This distance should not be less than 2 times the sum of the diameters because if the distance is too small the belt will have to run too tightly for best operation and if the distance is too great the belt will flap considerable.

Considering now that the motor is properly located and the right kind of mounting has been built, the next step is to properly align the motor with its drive.

The tools usually used for aligning motors or aligning shafting are the square, plumb-bob and level. The first step to be taken in aligning two machines is to see if they are level. It is possible for a machine to be out of line in more than one plane. If by placing a level or plum on a machine it is found to be out a certain amount, then the motor must be mounted so it will also be out a like amount.

Belt drive is the most common form of mechanical transmission, but the principles involved and the method used apply, in general, equally well for chain drive.

Fig. 1 illustrates a very easy method of aligning a motor pulley with a driven pulley. First the crown or center line of the pulleys must be on the same center line and second, the motor shaft must be parallel to the driven shaft.

By using a plumb-bob and drawing a straight line on the floor, you have something to work from. Next drop a plumb line from the center of the driven pulley to the floor. With a square, draw a line perpendicular to the datum line. Next drop a plumb line from the center of the motor pulley and move the motor up or back until

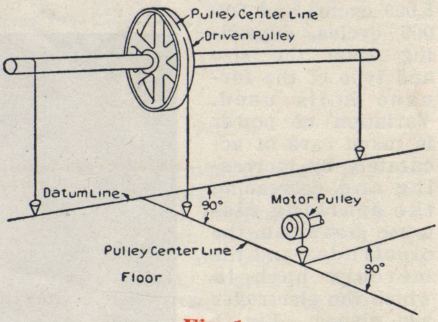


Fig. 1

the plumb-bob rests on the center line of the driven pulley. From the pulley center line, perpendiculars may be drawn through the centers of the holes in the motor feet. A level should be used to see that the line shafting is level. If it is not, then the motor feet must be shimmed up so that the motor shaft and the line shaft will be out of level the same amount. Chain drives may be aligned in a similar manner.

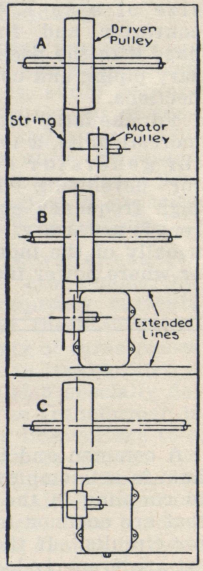


Fig. 2

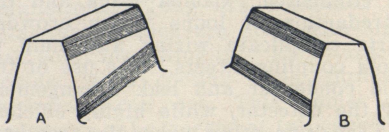
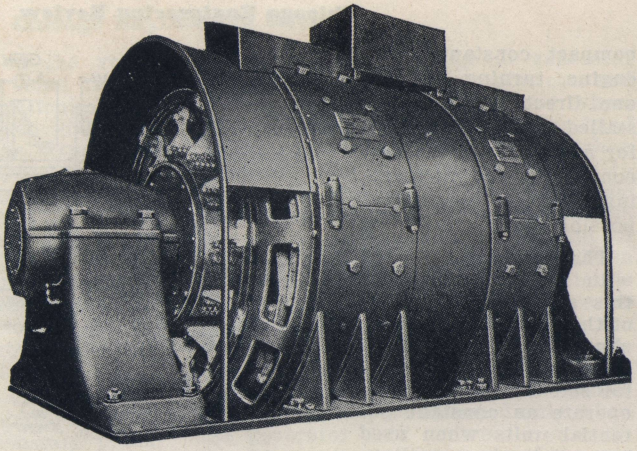


Fig. 3

(Continued on page 14)

Diesel-Electric Drive

Applied to Ships



Main Propulsion Motor of One of the Atlantic Refining Company's Diesel-Electric Tankers

DIESEL engines have been in use for quite a long time and are replacing steam engines more and more every year. The application of Diesel engines to marine work is still comparatively new, but the amount of horse power installed on ships is increasing every year. In the small vessels they find a very suitable field.

In tank service for oil, gasoline and other liquids, no other form of power has been found so efficient. The oil tanker uses the Diesel-engine-driven generator for driving the ship at sea and for driving the heavy oil-pumping equipment when in port. The equipment is rapidly being installed on tug boats, ferries, cargo vessels, cutters, yachts and dredges.

The chief point which distinguishes the Diesel engine from other forms of internal-combustion engines is the compression of the charge of air until the resulting high temperature is sufficient to explode the fuel without the aid of any external object. The fuel is forced into the cylinders by high pressure air from an air compressor. The Diesel 4 stroke cycle consists of: 1—the suction stroke in which a charge of pure air is drawn into the cylinder; 2—A compression stroke wherein this air is compressed by the pistons to a maximum pressure; 3—A period of injection and combustion of a charge of fuel and the expansion of the gases, the working stroke of the piston and 4—The exhaust stroke by which the burnt gases are expelled from the cylinder.

The driving equipment for a Diesel-Electric vessel consists of one or more Diesel engine driven, direct current generators, a motor or motors for driving the ship, a control or switchboard panel, a generator field rheostat, a control stand in the pilot house and the auxiliary generators which supply power for excitation of the main generators and for operating the ship auxiliary equipment.

With the Diesel electric drive, the speed of the engine is entirely independent of the direction of rotation of the propellor and also of the propellor speed. This means that a small

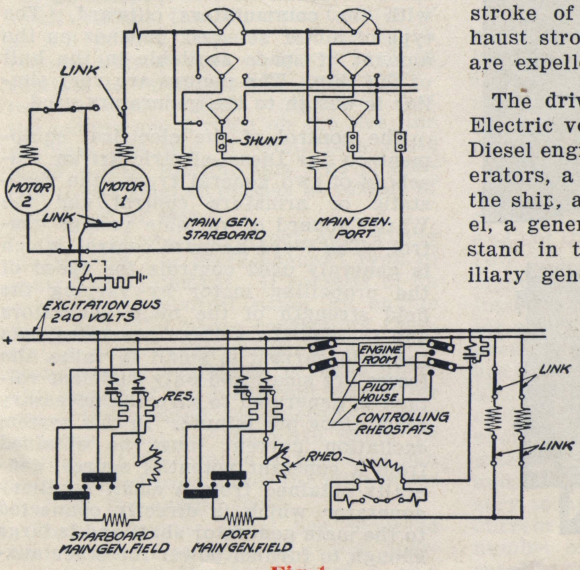


Fig. 1

compact constant speed engine, turning only in one direction can be installed. There is no need for a reversing gear and compressed air for starting is reduced to the least possible limit.

The generators used with Diesel engines for this service are usually of the separately excited, shunt field type. They are sometimes arranged for self excitation and to operate as constant potential units when used separately for auxiliary power. Generators are designed for direct connection to the engine.

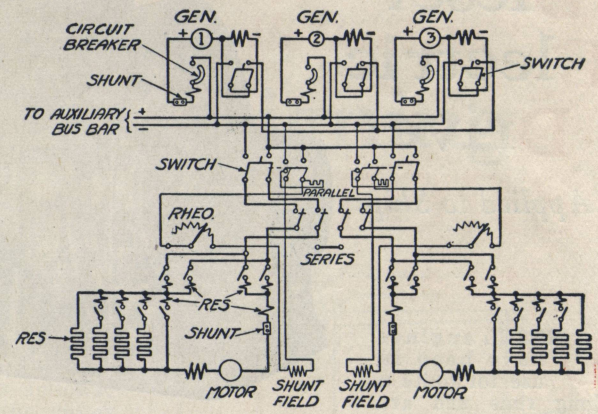
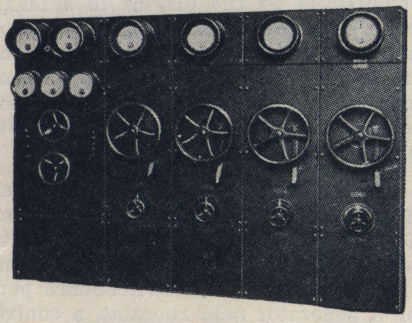


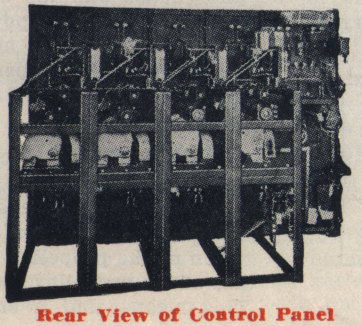
Fig. 2

When two or more Diesel engines are used with the variable-voltage system of control, the generators are connected in series. In any multiple or parallel combination, the various generators can be disconnected from the circuit and either shut down or connected to an auxiliary-power system.

The magnet frame is made so that the top half may be removed for inspection without removing the pole pieces. The shunt field coils are insulated to withstand moisture and chemical action.



Front View of Unit Control Panel



Rear View of Control Panel

The auxiliary direct current generators which supply power for excitation and the engine room equipment are designed for mounting on an extension of the main generator shaft, therefore are supplied without base shaft for the bearings. They are compound wound, constant potential types.

The main propelling motors which drive the ship are shunt wound machines, either of the single or double motor type. The double motor type consists of two separate motors mounted on the same base with their armatures mounted on the same shaft and with the commutators outward. The type of motor selected, depends on the amount of space available in the hull of the ship. The motors are very similar in design to the generators used.

The control of the electrical equipment on the Diesel-electric driven vessels is of two general types—the rheostatic or armature control and the Ward-Leonard or variable voltage control. The Ward Leonard control, which is generaly used controls the speed of the propelling/ motor by varying the field strength of the main generators and thereby the voltage generated. As the field current is small in value, the losses are small and only sufficient voltage is generated to give the necessary revolutions per minute. In this system excitation current must be obtained from a constant potential source, generally obtained from a small auxiliary generator which is directly connected to the main generator shaft and is large enough to furnish power for other aux-

iliary equipment used on the vessel. When the generators are being used for propelling the boat, variations in the motor torque at any given voltage is obtained by adjusting the strength of the motor field. This type of control makes the changes in speed very easy and the moving of the ship about from either the bridge or the engine room in a simple manner. As the controlling circuit handles only small values of current and the main line switches are opened and closed at zero voltage, the entire equipment is very simple mechanically and electrically.

With the rheostatic or armature type of control, the main generators are operated as self-excited, constant potential units, supplying current for both the propelling and auxiliary equipment on the vessel. The method of throwing the motors on the line and bringing them up to speed is similar to the practice used for any large direct current motor. Several blocks of resistances are placed in parallel in the armature circuit and cut in by means of solenoid operated contactors; on the last point of the controller the entire amount of resistance is short circuited. The master switch which operates the solenoid can be placed at any desired position in the system and therefore makes it very simple to control electrical apparatus. The variation in the torque of the motor may be obtained by varying the resistance.

This method of control is used for small vessels that operate constantly at full power; also for vessels which require a great deal of power load, in addition to operating the motors driving the vessel. Due to the fact that the motors are thrown on the live line requires the use of contactors quite large in size, limiting this type of control to the smaller classes of vessels of 1000 H. P. or less.

Fig. 1 shows the layout and wiring diagram of the Ward-Leonard type of control of equipment. It consists of an engine room control panel, an engine room and pilot house controlling rheostat, a pilot house panel. The engine room control equipment is made up of unit panels of the dead-front type. One panel is provided for each generator and one panel for the main motor or motors. It is arranged so that they can be controlled from either the pilot house or from the engine room.

Each generator panel has mounted on it a dead front type of switch operated by means of a hand wheel, a control switch for actuating the generator field circuit contactors, an ammeter and a voltmeter and a small hand wheel operated adjusting rheostat. The hand wheel operationg the main switches, generally has 3 positions, PROPULSION, OFF and MAIN POWER, the latter position being for connection to the power bus, where a large amount of power is used for other than propulsion purposes. The generator field switch is interlocked with main line switches, so that it cannot be thrown to either the propulsion or main power position, unless the main line switches are closed. The main line switches are interlocked so that they can be operated only when the generator field control lever is in the Off position. In this way a means is provided to prevent operating the main switches with the generator field excited.

The motor panel has mounted on it, a voltmeter, ammeter and propelling speed indicator, also the hand wheel for operating the engine room controlling rheostat and a selector switch for shifting the control to either the bridge or engine room. The ship can thus be operated from the engine room as easily as from the bridge.

The propulsion control equipment for a vessel fitted with rheostatic or armature control is shown in Fig. 2 and consists of an engine room panel, a motor control groups, starting resistors, and master controllers. The engine room control panel has the rheostats necessary for adjusting the voltage of the main generator, switches and circuit breakers for disconnecting the generator from the main bus; and rheostats for regulating the field of the propelling motors, motor cutout switches and the control station selector switch.

The motor control groups contain contactors for reversing the motor armature circuit and those for cutting in and out the blocks of starting resistors; two levers for operating the contactor manually in an emergency; and overload relay to trip the armature contactor should the armature current become excessive. The starting resistors which are inserted in the armature circuit are also used to obtain different speed variations, and are designed for continuous operation on any resistor point. The master switches are of the drum type, and as they handle the current necessary to operate only the solenoids, the current values are very small. Any number of master switches may be located in any desired position in the ship.

Scintilla Aircraft Magnetos

A Timely Description of a Most Important Aircraft Accessory

NO doubt one of the most important parts of an airplane is its ignition system. At the present time the majority of airplanes use for ignition purposes, high tension magnetos. Such examples are the magnetos made by the Scintilla Magneto Co., 225 W. 57th St., N, Y. City.

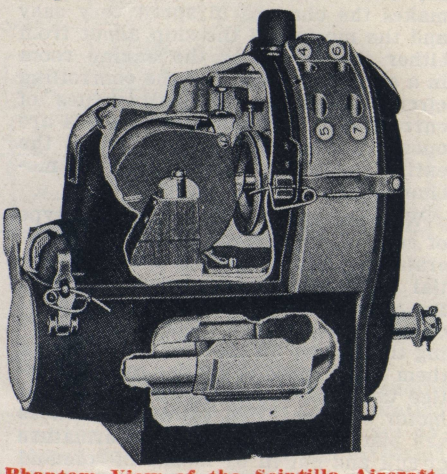
These magnetos, especially as used on the Wright Whirland engine are somewhat out of the ordinary and instead of the ordinary horse shoe magnet—one bell shaped magnet is used—the rotation of the magnet producing in the core of the coil a reversal of magnetic flux. The contact breaker mechanism is held in position by a bayonet lock and can be completely removed by hand.

The Scintilla Aircraft Magneto when taken apart can be divided into 8 main sections, one, the rotating magnet; two, the contact breaker; three, the front end plate; four, the coil; five, the magneto housing; six, the main cover with booster and ground connection block; seven, the distributor block; eight, the breaker cover. In Fig. 1 you will see a picture of the magneto with part of the cover and magneto housing cut away and in Fig. 2 you will see a detailed drawing of the parts of this particular special type of magneto.

The rotating magnet is supported in the magneto housing by the drive end bearing and the breaker end bearing, designated on the drawing by the figure 1. The contact breaker assembly mechanism is carried by the breaker cage. The breaker cage has ground and compensating rings riveted to it.

The coil is mounted directly on the extensions of the laminated pole shoes, thus insuring the coil a maximum freedom from oil and grease as this mounting puts it well up under the main cover. The pole shoe extensions are grounded to insure a good contact with the core of the coil. The coil is held in place by a screw at each end of the core. The condenser is built as part of the coil. This insures protection for the condenser and a practically uniform capacity irrespective of temperature and moisture.

The high tension carbon brush holder and safety gap electrode are mounted on the front of the coil. The ground

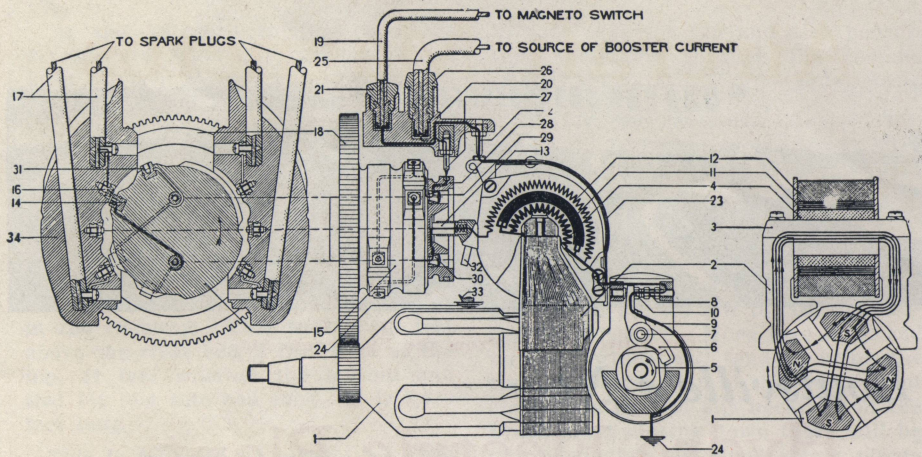


Phantom View of the Scintilla Aircraft Magneto.

connection and the spring contacts for the insulated supports of the stationary contact point are mounted in the primary bridge which extends over the top of the coil and is secured by small screws.

The mechanical and electrical principles of the Aircraft magnetos are very simple. The rotating magnet (1) has four poles, the poles are joined together inside the laminated ends into pairs, the two North Poles making up one pair and the two South Poles making up the other pair. The rotating magnet revolves between the laminated pole shoes (2) producing an alternating current in the core of the coil. When the current reaches its maximum value, the breaker cam causes the breaker lever to turn on its axis and opens the platinum contact points.

The cam is mounted on the rear end shaft of the rotating magnet, its position being fixed with relation to the magnetic field. The short contact screw is connected to the ground through the brake lever and the main spring for the breaker lever, while the long contact screw fits into the insulated supports maintaining permanent contact with the primary winding by means of laminated copper brush fastened on to the primary bridge. Therefore, when the contact points are



1 *Rotating Magnet*
2 *Pole Shoes*
3 *Core of Coil*
4 *Primary Winding*
5 *Breaker Cam*
6 *Breaker Lever*
7 *Breaker Lever Axle*
8 *Long Contact Point (Insulated)*
9 *Main Spring for Breaker Lever*
10 *Short Contact Point*
11 *Condenser*
12 *Secondary Winding*
13 *High Tension Carbon Brush*
14 *Segment in Distributor Cylinder carrying Secondary Current*
15 *Distributor Cylinder*
16 *Electrode in Distributor Block*
17 *Ignition Cable*
18 *Large Distributor Gear*
19 *Ground Wire*
20 *Booster and Ground Connection Block*
21 *Fastening Screw for Ground Wire*
22 *Stud for ground contact*
23 *Primary Bridge*
24 *Ground through the Magneto and Engine*
25 *Booster Cable*
26 *Fastening screw for Booster Wire*
27 *Electrode for Booster Current*
28 *Collector ring for Booster Current*
29 *Fastening Screw for Collector Ring (in Booster Circuit)*
30 *Fastening Screw for Collector Ring (in Secondary Circuit)*
31. *Segment in distributor Cylinder carrying Booster Current*
32 *Safety Gap Electrode*
33 *Ground Plate for Safety Gap*
34 *Distributor block*

opened the primary circuit is suddenly interrupted.

The condenser is connected in parallel with the contact points because one end of the condenser is connected to the pole core, completing the ground to the ground on the breaker. It prevents arcing at the points when the primary current is interrupted, thus reducing their wear to a minimum and insuring regular sparking.

The high tension type of brush transmits the current which is induced in the secondary through the spark plug, through the distributor cylinder and the distributor blocks and the ignition cable. The high tension brush bears on the central contact of the collector ring which is secured to the distributor cylinder by two fastening screws. The screw is located in the secondary current circuit and connects the central contact in the collector ring for booster current with the conductor bolted into the distributor cylinder and leads of the segment.

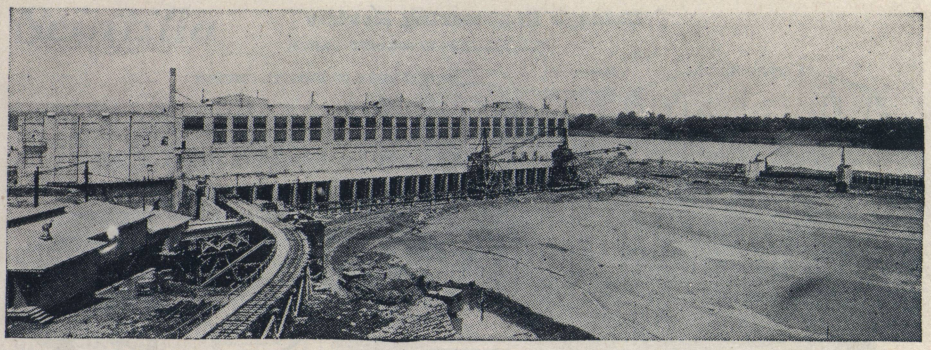
The distributor cylinder is fixed on the large distributor gear in a definite position relative to the opening of the contact points and for a given rotation which in the diagram is anti-clockwise.

The safety gap is the space between the insulated electrodes which screws into the high tension carbon brush holder and the electrode on the safety gap ground plate. Its function is to protect the coil against excessively high voltage by providing a means of escape for the charge, which will jump the gap between the electrodes in the event of the secondary circuit being accidentally broken between the plugs and the coil.

The advancing and retarding of the ignition is obtained by moving the breaker assembly about the cam. Moving the breaker assembly against the direction of rotation gives advance, while moving the breaker assembly with the direction of rotation gives retard.

In stopping the engine, ignition is cut out by neutralizing the functioning of the contact points. This is accomplished as follows. The end of the primary winding terminates through the spring contact at the top of the primary bridge and then through the stud for ground contact through the primary terminal marked P and carrying the fastening screw for the ground wire.

The ground wire goes to a switch located conveniently for the pilot. When the switch is closed the effect of the contacts is neutralized by permitting the primary current to flow around the points, through the switch to the ground, thus grounding the primary current and causing ignition to the engine to be shut off entirely.



The Power House From the Up-Stream Side

Louisville's New Hydro Electric Plant

By Student Bryce E. Warner

IN OCTOBER, 1927, there was put into operation at Louisville, a new hydro electric plant deriving its power from the Ohio River. It is the seventh largest hydro plant in the United States and is the largest automatically controlled plant in the world.

Twenty-five months passed from the time that construction was begun until the plant was ready for operation, yet it was completed one year ahead of schedule. The maximum number of men employed in the construction was 2,000 working three shifts of eight hours each.

The plant was built by the Byllesby Engineering and Management Corporation of Chicago for the Louisville Gas and Electric Company. The large dam that was necessary for this project was also built by Byllesby for the U. S. Government and the Gas and Electric Company pays the Government a rental for it. All construction was under the supervision of A. G. Butler, Gen'l. Supt. of Construction of the Louisville Gas and Electric Company and the electrical installation and equipment was in the charge of N. C. Pearcy, Electrical Construction Engineer.

The turbines are housed in a re-inforced concrete structure 508 feet long, 150 feet high, and 47 feet wide which places a weight on the river bed of 400,000 tons. In its construction there was used 708,000 pounds of structural steel, 4,000,000 pounds of reinforcing steel, and 62,500 yards of concrete.

At the very bottom where the tail race begins, mounted on a concrete cone, there is an end bearing of lignum-vitae upon which rests the 23-inch shaft of the water wheel or runner, and the alternator. Above this, several feet, on another level, a larger cone is raised in the center of which is the runner, surrounded by the guide vanes. These guide vanes can be opened or closed to regulate the amount of water acting on the runner and thereby control the output of the alternator. The water wheel and other parts of the driving equipment were manufactured by the Allis Chalmers Company and the electrical equipment by the General Electric Company.

The Alternators of which there are eight at present, are of 10,000 KW capacity, giving the plant an output of 80,000 KW. Arrangements were made at the time of construction for installing an additional two units later which will give a total of 10 units and an output of 100,000 KW.

The alternators are driven at a speed of 100 RPM and the output is stepped up from about 13,800 volts which is the output voltage of the alternators and carried to the Waterside Steam plant two miles away for distribution. The transmission system being steel towers and copper and steel stranded cable carrying a potential of 66,000 volts.

The cubicle control system is used and three men on a shift are all that are required for the operation of the plant.

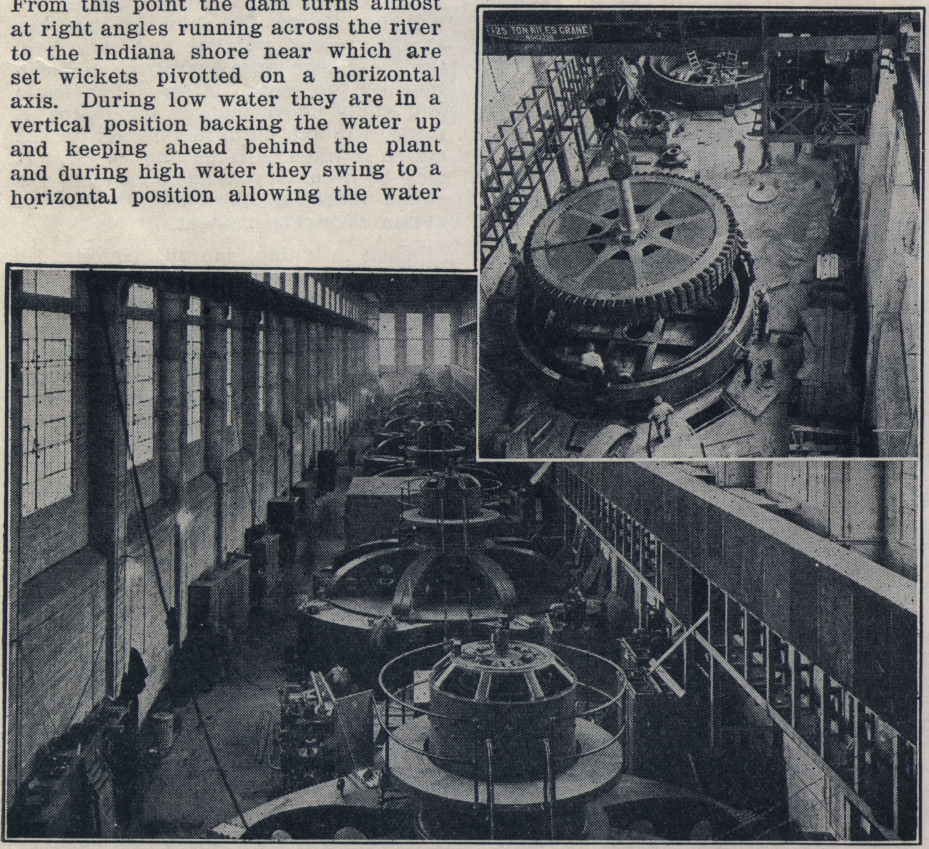
At the entrance to the penstocks screens are lowered in grooves which keep all debris from entering and by chance clogging or damaging the guide vanes or runner. Stop logs can also be lowered in grooves provided for that purpose shutting out the water from any unit in case that becomes necessary.

In the fixed weir or retaining wall of the dam there is a beartrap or spillway which regulates the amount of water in the raceway. This wall is 42 feet above the river bed, 3 feet wide at the top, 24 feet wide at the bottom and tied 3½ feet into bed rock. It is 2,620 feet long.

This is followed up stream by 4,980 feet of wall which is almost the same, except that it is sloped on both sides and is 3 feet wider at the bottom. From this point the dam turns almost at right angles running across the river to the Indiana shore near which are set wickets pivotted on a horizontal axis. During low water they are in a vertical position backing the water up and keeping ahead behind the plant and during high water they swing to a horizontal position allowing the water to pass over the top and also permitting navigation through the Indiana Chute.

To clear the harbor at Louisville required the construction of a single span in the transmission line from the hydro plant to Waterside plant of 3,000 feet with a sag of 120 feet.

A steam plant is to be built nearby the hydro plant at a later date with a capacity of 250,000 KW to cost approximately $6,000,000. More load is picked up daily which will tend to bring the time of construction of the steam plant closer. In case of any necessity of the hydro plant closing down there will be two adequately equipped steam plants to carry the load assuring uninterrupted service.



Interior of Louisville Hydro Plant Showing the Eight Units in Place. Insert: A 125 Ton Niles Crane Placing the Rotor of Unit Number Six.

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PRACTICAL METHOD OF ALIGNING MOTORS

(Continued from page 6)

Method of Aligning Two Pulleys

With a belt drive, a sliding base is nearly always used to allow for belt adjustment. Another method, therefore, is to use the following procedure when aligning two pulleys.

In Fig. 2 I have shown you a very good method to use in aligning two pulleys. First, place the motor on the base so there will be an equal amount of adjustment in either direction and firmly fasten the motor to the base. Second, mount the motor pulley on the motor shaft. Third, locate the base and motor in approximately the final position as determined by the length of the belt. Fourth, stretch a string from the face of the driven pulley to the face of the motor pulley as shown at A Fig. 2. Fifth, be sure to parallel the face of the motor pulley with this string, as shown in illustration B of Fig. 2. Sixth, using a scratch pin, mark the end positions of the sliding base as indicated. Seventh, extend the lines as illustrated in the drawing. Eighth, move the motor and base away from the string an amount equal to one-half the difference in face width of the two pulleys, using the two extended lines as a guide to keep the base in its proper position, as shown in illustration C of this drawing. Nine, the belt should now be placed on the pulley to see if it operates satisfactorily. If it does not operate properly the base may be shifted slightly until proper operation is obtained.

Aligning Gears

It is important with gear drive to have the gear and pinion mesh properly and to have the two shafts parallel in both vertical and horizontal planes.

An easy and fairly accurate method of checking alignment of gears is shown quite clearly in Fig. 3. Coat both surfaces of gear teeth with a thin layer of white lead, then rotate the motor shaft slowly by hand and after the coated surface has passed over the pinions, an impression will be obtained that will look similar to either A or B. The coated portion of both surfaces represent the white lead, the white portion being the surface where the lead has been rubbed off, due to the sliding action of the two gears. If the alignment is not right, an impression like A will be the result, showing that the shafts are not parallel and therefore, the gears bear more heavily on one side than on the other. After a few trials and slight movement of the motor, a fairly straight uniform line across the entire surface will be the result. It may be necessary in some cases to use shims under the motor feet, in order to obtain correct alignment.

When aligning fabroil pinions, be sure that the gear does not run on the metallic shrouds of the pinion, due to the end play of the rotor.

Direct connected or gear drive motors are best mounted so as to be an integral part of the driven machine. Brackets or a platform constructed of odd pieces of structural steel shapes make very satisfactory supports for attaching the motor to the machine. Such installations are rigid and also readily made with small cost.

Motors that are direct connected must be lined up properly, that is, shimmed if necessary so there will be no binding effect on the motor shaft or driven shaft. One of the most important points is proper bearings fit.

Or Lon Chaney

"What's the difference between a locomotive and a tack hammer?"

"I don't know; what is it?"

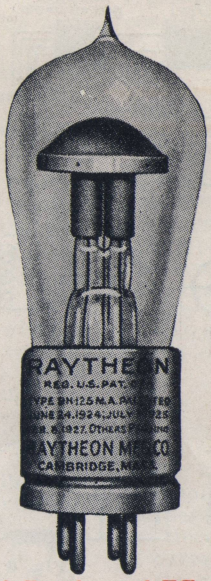
"Well, then, never buy a tack hammer because it might turn out to be a locomotive."

A Few Things You Ought to Know About

Radio "B" Power Units

ALTHOUGH there are several different types of B power units now in use, every one of them performs four functions as shown in Fig. 1.

First, the transformer changes the voltage to the required value. Next, the current is rectified or changed from alternating current to pulsating direct current. This pulsating current, of course, is not suitable for radio work, so it must next pass through a filter where all the humps and wrinkles are straightened out, leaving a non-fluctuating direct current. Next, the direct current voltage is adjusted to the proper value, after which it is ready for use in the receiver.



A Popular and Efficient "B" Power Rectifying Tube.

Power Transformers

The transformers for changing the voltage are of the power type, having iron cores. Some of these transformers have taps on the primary for changing the voltage and controlling the output. There may be one, one, two or three separate secondary windings, depending upon the type of power unit. Several types of transformers are shown in Fig. 2.

For a full wave rectifier, the high voltage winding of the secondary is tapped at its electrical center and brought out as the —B connection, but this is not necessary with a half wave rectifier.

Rectifying Tubes

The rectifying devices used in B power units are of two general types, tube rectifiers and chemical rectifiers. Tube rectifiers have the advantage of requiring less attention and since they contain no liquids or chemicals, they are never "messy" and require no attention or care, except renewal of a tube in case of a burn out or other trouble.

One type of tube which is used very much is the Raytheon. It is provided with a 4 prong base like a vacuum tube and can be used with a standard socket, but only 3 of the prongs are used. The grid terminal of the socket is left unconnected. No filament is provided, for the tube rectifies current through the action of rare gases such as helium. This gas would carry current in both directions, were it not for the fact that the 2 point connections (shown at A, Fig. 3) have very little surface and therefore present a poor target. On the other hand, current can get away from these cathodes and pass through the gas to the anode, with very little trouble.

A small amount of current does flow from the large electrode to the small one and this is known as back current. The more back current, the more difficult it is to eleminate the hum.

The tubes shown in Fig. 3-B is a gas rectifier similar to the Raytheon except that a small filament or ionizer is provided to lower the internal resistance of the tube. Fig. 3-C shows a rectifier tube that is quite different from those we have talked about so far. This makes use of electron flow between a hot anode or filament and a cathode or plate. This electron flow provides a path for the current from the plate to the filament, but will not let current flow from the filament to the plate.

The filament of such a tube may be heated either from the battery or from a special winding on the power transformer. The tube is a single wave rectifier, because it rectifies only half of the alternating current wave.

A double wave rectifier of the same type may be made by adding another filament as shown in Fig. 3-D. With two filaments the current at one instant flows from the plate to one of them, then when the current reverses it flows from the plate to the other filament.

An ordinary vacuum tube as shown in Fig. 3-E may be used as a rectifier, but is suitable only for very small amounts of current. On most power

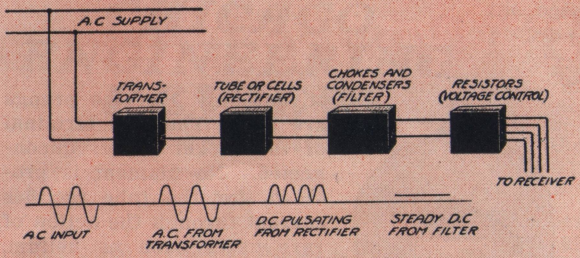


Fig. 1

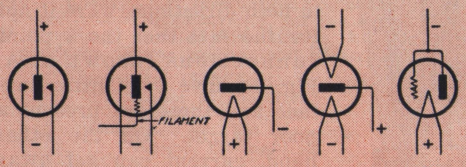


Fig. 2

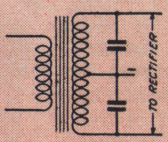


Fig. 4

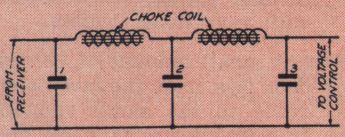


Fig. 5

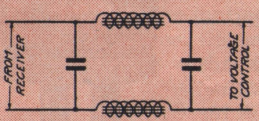


Fig. 6

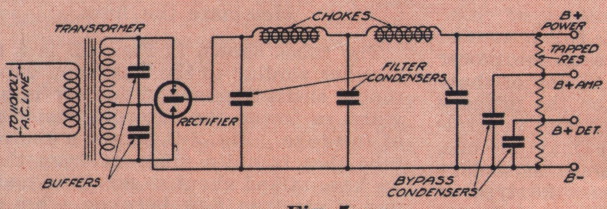


Fig. 7

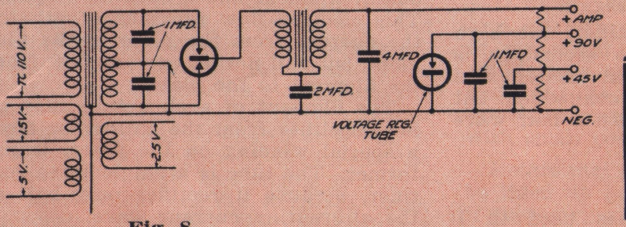
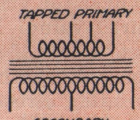
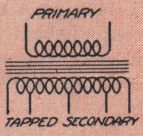
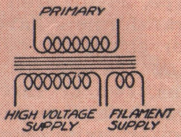


Fig. 8







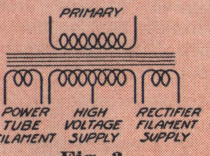


Fig. 2

units 2 condensers are connected between the center tap of the transformer and the outside terminals as in Fig. 4. These two condensers are called buffers and although they are not absolutely necessary they stabilize the action of the rectifier.

Filter System

The filter system of a power unit makes use of a combination of choke coils and condensers. This part of the unit must be carefully designed and constructed. If the condensers are too small, the unit will not handle full load properly while if the chokes are too small, there is sure to be a hum in the receiver.

Two very common arrangements of condensers and choke coils are shown in Figs. 5 and 6. Note that in Fig. 5 both choke coils are connected to the

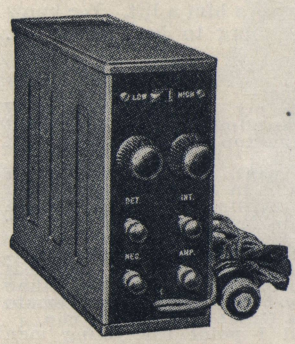
A Well Known "B" Power Unit

positive side of the line while in Fig. 6 one is connected to the positive and the other to the negative.

The choke coils tend to oppose any change in the flow of current through them, thus helping to smooth out pulsating direct current. Part of the pulsating voltage is stored up in the condenser so when the current through the choke coil begins to fall, the condensers help to maintain a steady flow, so that after the current has passed through the filter, the output is perfectly steady direct current.

The complete connections for a standard B power unit are shown in Fig. 7. Note the voltage regulation is accomplished by means of a tapped resistance.

Fig. 8 shows the connections for a B power unit, the transformer of which is also provided with additional windings which may be used to supply the filament of alternating current tubes. The B power unit itself is very much the same as the one shown in Fig. 7 except that a voltage regulator tube is used in connection with the tapped resistance in order to maintain a constant voltage at the output. This tube will store up the power that is not required of the receiver and causes the power unit to deliver an unvarying amount of power at all times.



Another Commercial Type

B power units, using chemical rectifiers are similar to those described in this article except that rectification is accomplished by means of chemicals instead of a rectifying tube. The other parts of the rectifier are exactly the same.

It is now common practice to combine B power units and power amplifiers. These combined units, however, consist merely of a B power unit, such as described above and a standard audio frequency power amplifier.

The Latest in Super-Power Tubes

A new super-power tube, to be known as the UX-250 or CX-350, has been announced. This tube is a larger and more powerful amplifier than the UX-210 type. It provides a far greater loud-speaker volume, without distortion, than has heretofore been possible. It may be used at a fraction of its full capacity, thus making possible undistorted output at all times.

Testing Amplifier Tubes

The common practice of using alternating current for heating the filaments of amplifier tubes has provided a new market for a. c. meters. These meters are necessary to determine the volume of current flowing through the filament or the voltage applied to the terminals. Meters designed for direct current and steady voltage cannot be used for this purpose. If a d. c. voltmeter is placed across an a. c. line the needle will not deflect.

Cleaning the Soldering Iron

Electric soldering irons, when used with rosin-core solder, become coated with a deposit, making clean joints difficult. To clean the iron, use a jelly glass filled with sand which is moistened with a sal-ammoniac solution. Plunging the iron into this mixture quickly cleans and tins it.

How to Prevent Tube Blowouts

The most common cause of accidental burning out of tubes is letting the B-battery voltage get across the tube-filament terminals. When testing a new set it is an excellent idea to connect the 6-volt A-battery to the B-terminal plug in all the tubes and make sure that no filament lights. If a filament does light, it is an indication that the B-lines are crossed with the A-wiring somewhere in the set, and this fault must be located and remedied. If no filament lights, it is quite safe to connect the B-battery to its terminals.

The BEST TRAINING Brings the BEST JOBS

Cooke Trained Men are "Putting it Over" in Every Branch of Electricity

—And the Same Training that Boosted Them Will Boost You, Too

Job Ticket Handbook Help Burnside Make Good On Job Paying $350 a Month and Expenses

Many a man would give his "eye teeth" for a job like the one Charlie Burnside holds. Imagine the fascination of traveling around from one job to another with a salary of $350 a month and all expenses paid. Charlie knew nothing about Electricity when he started studying the Chief's Course. But has he made good? You ask him.

C. L. Burnside

Missoula, Montana
226 No. 1st St.

Dear Mr. Cooke:

I am still on the move. The company keeps sending me around to different jobs.

I am working here on the construction of a new mill and have a very good job.

I am still proud of your Course, I feel that I can get a job and hold it down anywhere, now. I never expected so much returns from it when I took it.

I am working for the Amalgamated Sugar Company getting $350 a month and traveling expenses. Your Job Ticket Book is sure fine. I like it very much, because it helps me in many ways every day. Your student, CHAS L. BURNSIDE

"You Were Not After My Money," Says Lapham

Although he had paid for his training in full, Otis Lapham stood a change of losing the best part of it because, to put it in his own words, he had laid down on the job. What he meant was, that he had quit studying and was making no attempt to finish his course. But like he does with all his students the Chief kept after him with the result that his $9 a week salary, which he tells about in his letter, has grown ten times—to $90 a week.

Dear Mr. Cooke: Osseo, Michigan.

I wish to thank you for what you and your course have done for me. You have lived up to every promise that you have made. Even after I had paid up in full and laid down on the job you kept writing and urging me to study and finish the course and so I did. It is easy to see you were not after money alone. It was about a year after I had received my diploma that I came out to Chicago to visit the School and put in some time at your Laboratory. I sure was treated fine. You even paid for two weeks room rent at the Y. M. C. A. Hotel. While there I met students from all over the old U. S. A. I was surprised to find your Laboratory fully equipped with up-to-date Electrical Machinery. And to think that your students can stay as long as they wish and receive free instruction.

I haven't made out yet how you can do all that for the money you are asking for your course; and that is the honest truth.

If any one wants to learn electricity your course is the one to take and I am sure they can make it for it is a practical course which anyone can learn and put to good use.

When I enrolled for your Course I was a senior in high school and 17 years of age. I had been doing farm work for $1.50 a day. I now carry a Detroit city Wireman's and Fixtureman's license also Union Card. I am contracting and am holding my own with the old timer's. I have advanced some from $1.50 per hour because now I average over $90.00 a week.

Thanking you again for all you have done for me in the past six years I remain your loyal student and booster.

OTIS G. LAPHAM.

Made Foreman in Electrified Mine

Student Owen is one of hundreds of the Chief's students who have applied their training where opportunities are so plentiful — in the electrified coal mines. Mr. Owen has done some work in electricity before beginning his Cooke training, but even in spite of his experience he did not go "up" very fast until training gave him a lift. We know that you are going to hear from Mr. Owen again.

Palmer, Tenn.

Dear Instructor:—

In finishing my course with you I must say I am climbing the ladder and bidding for the top berth in Electrical work.

I am at present, mine foreman with state certificate, in charge of electrical coal cutting, drilling and pumping. I also hold the office as meter reader for substation at this place.

I attribute all my success to the teachings of my instructor — the practical teachings of a practical man. As I climb the ladder my heart will always remain warm for the Great School you run.

Always will I point the young men the Cooke Way.

Respectfully, F. N. OWEN.

Made Manager of Ice Cream Plant Because of Electrical Knowledge

John Robbins letter proves that Cooke Training prepares a man for even more than an electrical job. Hundreds of other students have written similar letters to the Chief, and they all prove that in this age, no matter what kind of work a man is doing he is better off with a knowledge of electricity.

J. N. Robbins

Vernon, Texas
P. O. Box 1796

Dear Chief:

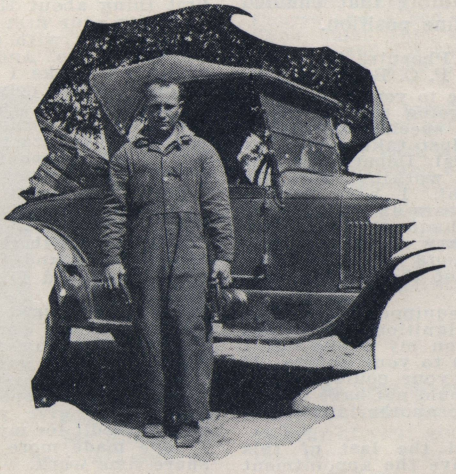
The company which I work for bought another Ice Cream Plant, at Vernon, Texas, a small town of 12,000 people, and selected me as manager of their new plant at a salary of $100 per month more than I have been getting. Since then, I have had to move my family and get myself established in my new place and get acquainted with the people and everything in general. Now you may ask in what way did I have anything to do with it? This new plant is using everything electrical and in looking for a manager they wanted a man who could handle every phase of the business.

There were other men in his employ who could handle the office, others who could handle the freezing and others who could handle the electrical machinery. I do not mean to boast but I was the only man who could handle it all and you are responsible for my being able to handle the electrical machinery, where most of the others fell down.

With best wishes,
Your friend and student,
JOHN W. ROBBINS.

With 5th Grade Schooling $20 a Week—With Cooke Training $90 a Week

Frank Brown enrolled for the Chief's Course with the understanding that lack of schooling wouldn't prevent him from being successful in electrical work and his record proves that he was right. With only a fifth grade education to help him, a man can't go far. But with the fifth grade plus Cooke Training a man can do wonders.



Frank Brown, Jr.

Abita Springs, La.
P. O. Box 15

Dear Mr. Cooke:

When I enrolled for your Course of training, I was working in a bakery for a firm by the name of Abita Baking Company and at that time I was earning $20.00 a week, I knew absolutely nothing about electricity and I had only gone to fifth grade in school.

Since studying your Course, however, I got started in the electrical contracting business for myself and am now doing house wiring and electrical work of all kinds and I average about $90.00 a week. I have one man working for me, I have made friends with a carpenter contractor here which has helped me quite a bit. Right now I have twenty-five houses waiting for me to get busy and wire and I owe all of this success, Mr. Cooke, to your Course and the advice you have given me. I certainly can't thank you enough for what you have done for me, I don't think your Course can be beaten.

Yours very truly,
FRANK BROWN, Jr.

Training Doubles Salary in 5 Months

Luis Saldana, untrained, earned $90 a month doing odd jobs for an electrical contractor. Then seeing that he wasn't getting anywhere he enrolled for Cooke Training and five months later his salary was doubled.

3824 Virginia St.,
Gary, Indiana

Dear Mr. Cooke:

Just a line to thank you for what you did for me in order to get me fitted for my present position.

Three months before I started working in Electricity I was making $90 a month but liking the work and wanting to get ahead I enrolled for your course. Five months later I was making $195. a month—twice as much as I was making before — and I am making some extra money in my spare time.

I want to thank you once more for your service, and the many ways in which you helped me. If any of your boys want to know about success let them send me a line. The L. L. Cooke Course is worth a hundred times more than it costs.

LUIS SALDANA.

Earned $80 a Month When He Started—Now $200

F. W. Pauli

Student Pauli, while not overlooking the advantages of more than doubling his earnings, looked a whole lot farther than that. He realizes that Cooke Training is more than a mere training for a particular job or a particular kind of work. It's an education—an opportunity—for the average man to improve his entire life.

Sutherland, Iowa.

Dear Chief:

Have just received your Diploma for which I wish to thank you. I think I have received many times my money's worth from your Course, as it not only teaches one a trade, but also educates one in other ways. My salary averaged $80 per month when I started with you and I would have to do anything that came along. Now I am getting $200 a month and only getting started.

Yours forever,

F. W. PAULI

Superintendent of Street Railway System

Since Student McNely wrote the letter below, he has been at work for some time on his new position as superintendent for the Phoenix Street Railway System. You will note that he says it was his Cooke Training that enabled him to obtain this fine position.

Phoenix, Arizona,
P. O. Box 903.

Dear Chief:

I promised to write to you and let you know what I was going to do when I wrote for all those special lessons, so here goes. I have just taken over the Automotive Electrical Department for the State of Arizona working under the Highway Department. I have several hundred trucks and cars as well so that many catapillars and other tractors, besides all the stationary engines such as hoists, air compressors, water pumps, dredgers, and such of the like to take care of the ignition.

These engines are equipped with either magneto or battery ignition, so you see I have quite a job on my hands but I can handle it thanks to your Course. If it had not been for your course in applied Electricity I would not have landed this position. I have another little bug to put in your ear.

Between now and the last of this month I am to receive the appointment of Superintendent of the Phoenix Street Railway Company and thanks to your Course again I will be able to handle this position also.

Now Mr. Cooke I want to thank you personally for the courtesy you have shown me and also for the help you have been to me. There is nothing that I can say that would praise you and your faculty high enough and whenever I can you can rest assured I recommend your school ahead of them all as your course is so simple a child can understand it.

Your faithful student and friend,

W. F. McNELY.

Spare Time Work Has Netted Him $4,000.00

George W. Russell

When George Russell decided to take the Chief's Course he didn't know the first thing about Electricity but after completing only sixteen lessons he accepted a position with the Western Electric Company at double his former salary. In a few weeks he was promoted as Head Inspector of the Private Switchboard Dept. That's going some. But in addition he made over $4,000.00 in spare-time work while studying. He gives Mr. Cooke and his school all the credit for his success

Aurora, Illinois
118 N. May St.

Dear Mr. Cooke:

When I enrolled I did not know the first thing about Electricity. But after studying your first 16 lessons I got my first position with the Western Electric Co. of Chicago. And after working there about six weeks I was made Head Inspector of the private switchboard department and I thought I would like some outside work so I went with an Electrical Contractor and stayed with him about six months. And then, I got an offer as journeyman electrician with the C. B. & Q. Ry. at 75c per hour. I had previously earned only 30 cents an hour.

I am still with the railroad and doing house wiring and general contracting in spare time and I have plenty of work to do.

We have bought a nice 5 room home with a two car garage on a corner lot, and I am going to install a battery charger in the garage and going into the battery business. I expect to make a good paying proposition of that and my wife and I give you and your School all the credit for my success. Up-to-date I have made more than $4,000 extra in spare time work.

GEO. W. RUSSELL.

Appointed New Business Manager for Southwest Power Co.

Sam Cunningham

Note that Sam Cunningham says — "Without your training I could never have gotten this position." The chief feature of Cooke Training is its completeness and the many different subjects it covers. It gives a man a thorough understanding of many things which hit-or-miss experience would never give him, and these are the very things which he must know to hold the top position.

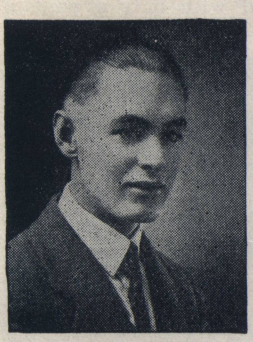
Dear Mr. Cooke: Fayetteville, Ark.

Received your letter of 2nd inst. regarding your writing Mr. S. T. Meneley of Southwest Power Co., about a job I had applied for. I am glad to say I got the place over three other applicants.

The position is New Business Manager. I have charge of rural development and rural distribution in the Fayetteville division, this place pays me considerably more per month than I have been getting and no limit to advancement. I wish to state that without your training I could never have gotten this position.

Thanking you, I am, Your student and friend, SAM CUNNINGHAM.

Gets Contract on Which He Makes $200.00 in 10 Days



W. E. Thayer

Will Thayer was working for $3.00 a day when he enrolled for Cooke Training and when he wrote the letter below he had completed only 18 lessons of his Course. Being ambitious he went into business for himself on a small scale and his first real contract gave him $20 a day for ten days work. Ask him if he thinks Cooke Training pays.

Las Animas, Colo.

Dear Mr. Cooke:

About three weeks ago I asked a fellow to let me bid on a job of wiring a filling station and he let me have his plans from which I did the figuring.

To make a long story short, I got the job of putting in all of the wiring and furnishing all of the material and fixtures. The amount of this job is $470.00 which gives me a profit of about $200.00 and it will take me about 10 days to do the job. I don't think this is bad for the first big job. Besides the advertising it will give me is worth something for it will let the people know that I can do the work and it will beat all newspaper advertising a person could do.

Your student,
W. E. THAYER.

President of Company Offers to Pay for His Course When Finished

It is a common thing for employers to pay back to a man every penny his Cooke Training cost him, as in Arnold Hamilton's case, which he tells about in his letter. Employers have learned the Value of Cooke Training. They know a Cooke trained man is the best man they can find and many of them are anxious to reward the fellow who will use his spare time to better fit himself for the employer's needs.

Waltham, Quebec, Canada.

Dear Mr. Cooke:

No doubt you have branded me a quitter, not having heard from me for two years. But I am back in the harness again and hope to finish my Course and receive my diploma just as soon as possible.

A few days ago the president of our company visited the plant while I was on duty. Noticing some of my lessons which I was looking over, lying on the desk, he asked me if I had finished the Course and I had to say NO. He said, "You finish that course and get your diploma and I'll raise your salary $25 a month and give you the price of the Course."

Now $25 a month more, means a lot up here so I'm getting busy.

I started back at about the 40th lesson and reviewed and now I am ready to answer lessons 55 and 56.

I am operating in the Pembroke Electric Light Company's Power house, on Black river at Waltham, Quebec.

Your student,
ARNOLD O. HAMILTON.

Tell the World

Let us hear about that new job or the raise that you got; we are always glad to hear of your good fortune and so are the rest of your fellow students—so, come on now, open up, let's hear about it.

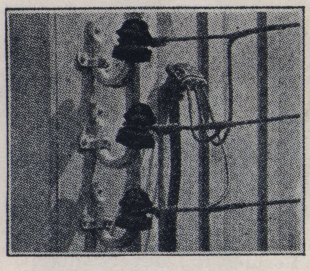


Fig. 2

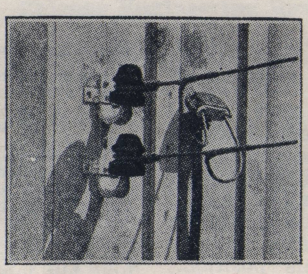


Fig. 3

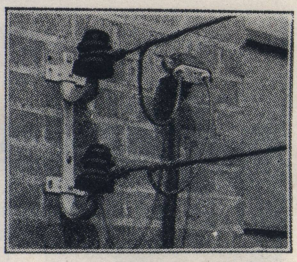


Fig. 4

How Service Connections *are Made*

The Pictures Tell the Story

IT IS customary in nearly all cases to wire a building before the wires from the power lines to the service switch are connected but this does not mean that no attention need be paid to the service connections until the other wiring is finished.

The very first thing in wiring a building is to find out where the power company will attach the service wires to the building. The power company usually connects the service wires at the point nearest and most convenient to their lines and they will designate where the service wires will be attached before the building is wired. It is then up to the wireman to make his plans accordingly and install the service conduit so it will terminate at this point.

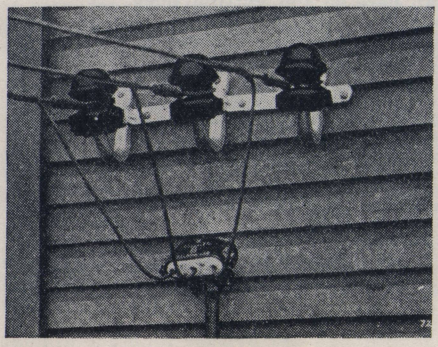
Usually the service switch is placed in the basement and the service conduit is run down the outside of the building, through the basement wall and then to the service switch. The National Board of Fire Underwriters specify that the service switch shall be placed as near as practical to the point where the wires enter the building so it is best to install it at or near the place where the service conduit passes through the basement wall if possible.

The accompanying illustrations show several methods of attaching service wires entering the service conduit. The brackets and fixtures shown in these illustrations are the well known Pierce line manufactured by Hubbard and Co., of Pittsburgh, Pa.

Fig. 1 shows a horizontal bracket attached to the side of a building which may be used when the service wires are taken from a horizontal crossarm.

Figs. 2, 3 and 4 show connections for house services using vertical brackets and pin type insulators. The service conduit and wires are also shown.

The swinging knob fixtures shown in Fig. 5 provide a cheap and easy method of attaching electric lights and telephone service wires to buildings. They are provided with two-inch screws and may be installed with only a pair of pliers.



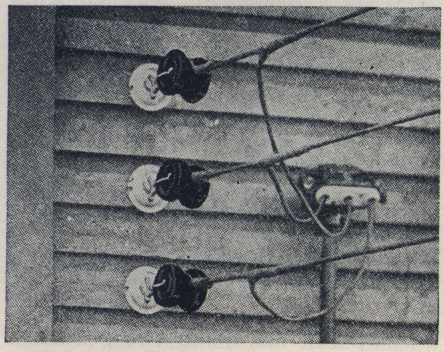


Fig. 5 Typical Service Connectors Fig. 1

Questions and Answers on the

Underwriters Code

All wiring must be installed so as to meet the requirements of the National Board of Fire Underwriters. These requirements are given in a wiring code book published by the Underwriters. The following questions and answers pertain to these rules:

Question:

1—How must outlet boxes in conduit runs be installed in respect to the surface of the walls or ceiling in which they appear?

Answer:

Outlet boxes or plates, switch boxes and cabinets will be so installed in walls or ceilings composed of plaster on wooden joists so that the front edge of the fitting will not set back of the finished surface of the plaster more than ¼". On wooden walls or ceilings, the front edge of the fitting will be flush with the finished surface, or project therefrom.

The above requirements in regard to the fittings, do not apply to walls or ceilings composed of concrete, tile or other non-combustible material.

Question:

2—Under what condition must fixtures be insulated from their support?

Answer:

Wherever the lighting fixture is used in combination with gas, the electrical fixture shall be insulated from the supports by approved insulating joints, placed as close as possible to the ceiling or wall and canopy insulators shall be used.

Fixtures mounted on metal ceilings or side walls, or on walls or ceilings containing metal lathing, shall be grounded or shall be insulated from their supports by approved insulating joints or by approved insulating fixture supports, and canopy insulators shall be used.

Question:

3—How must the wires in a concealed knob and tube installation be terminated at outlets?

Answer:

Approved outlet boxes or plates shall be installed at all outlets, and the flexible tubing shall extend from the last knob into and be secured to switch boxes or plates.

Question:

4—What is the most important thing to remember in regard to their location when installing junction boxes? What are the sizes of the boxes?

Answer:

One of the most important things to remember in installing junction boxes, is to install them in places to be accessible without removing any part of the building. Junction boxes are made in different sizes and junction boxes or pull boxes not over 150 cubic inches in size, shall be composed of cast steel, not less than .078" or No. 14 U. S. Sheet Metal Gauge steel in thickness, or of cast metal having a wall thickness not less than ⅛". Junction or pull boxes of over 150 cubic inches in size shall be composed of metal and shall conform to the requirements for cutout boxes. The covers may consist of single flat sheets secured to the box by screws or bolts instead of hinges.

Junction boxes are used only for enclosing joints in wires and to facilitate the drawing in of the wires or cables. They are not intended to enclose switches cutouts or other control devices.

Question:

5—What provision should be made for the extension of wires where the conduit systems enters the junction box?

Answer:

Openings in outlet fittings or cabinets, or junction boxes shall be equipped, either separately or as a part of the fitting, with couplings or bushings which will serve to secure the conduit, raceway or armored cable to the fitting and at the same time protect the insulation on the wire from being damaged in any way. Fittings may be purchased from any electrical supply dealer that will fit any standard size conduit that may be used, either flexible conduit or rigid conduit.

Question:

6—What is the requirement regarding the feeding of Exit light circuit?

Answer:

Exit light circuits, known as emergency lights, in fact all lights necessary to properly illuminate lobbies, stairways, corridors and other portions of a theatre or public building, to which the public has access which are normally lighted during the performance, such as in theatres, etc., emergency lights or exit lights shall not be connected or controlled by the stage lighting control but from another convenient place, such as in the lobby and these circuits shall be separate from the lighting circuit that is used to furnish light for illumination.

Question:

7—How should dimmers in theatre wiring be wired with respect to the balance of the circuit of which they form a part?

Answer:

All lights acting as dimmers shall be so connected that they will be dead when their respective circuit switches are open.

Question:

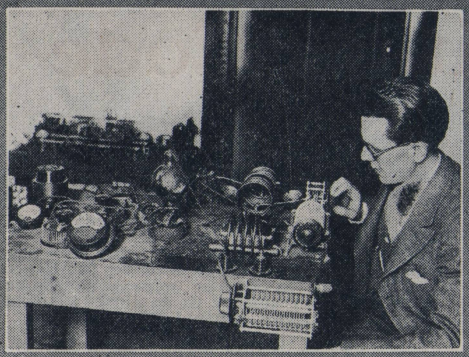
8—When wires are run in damp places, how must wires be supported?

Answer:

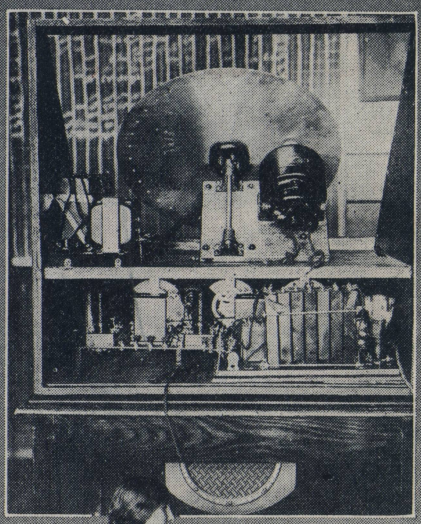
In ice houses, breweries and other damp places, rubber covered wire should be used and rigidly supported on non-combustible, non-absorptive insulators which separate the wire at least one inch from the surface wired over and should be kept apart at least 2½" for voltages up to 300, and for voltages higher than this, they should be kept apart 4". In many cases lead covered cable is used for installations in damp places and wires used for underground service are lead covered.

Wires of armored cable shall be of rubber covered type. The armored cable should carry a distinct marker, that is, wires with insulation upon them whereby they can be easily distinguished throughout the entire length of the cable.

WHAT'S NEW IN ELECTRICITY



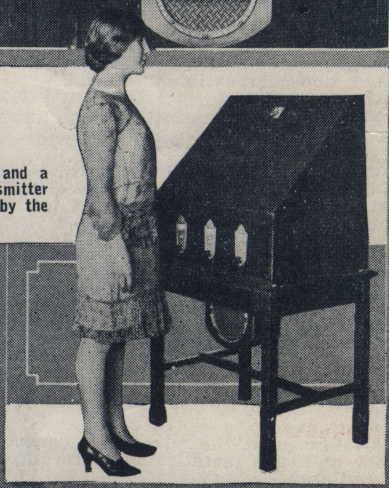
Above: Charles K. Atwater, Montclair, N. J., with a new 10 meter radio transmitter, used in a two way conversation test across the U. S.

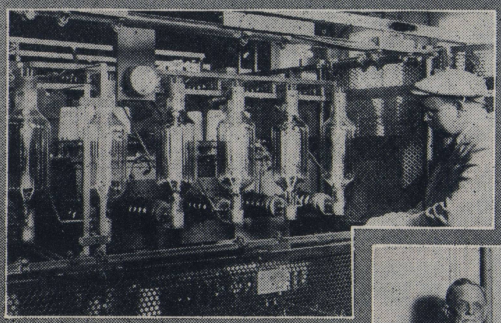


Two Pictures to Right: Interior and exterior views of the new Radio Television Receiving Set.

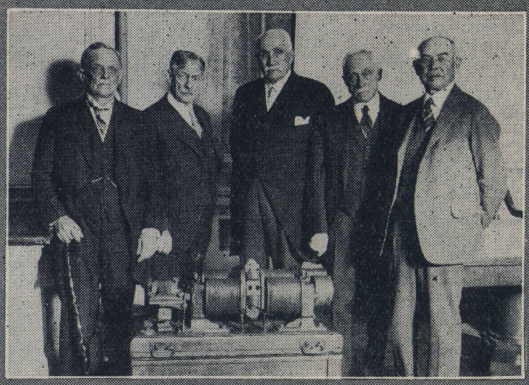
The transmitter consists of an illuminating box, lens and focusing device and a motor driven scanning disc. The person to be "televised" sits in front of the televisor and the image is sharply focused on the scanning disc. Behind the disc is the photo-electric cell and amplifier which convert the units of the image into electrical current impulses to be broadcasted.

The receiver consists of a common radio receiver, a disc and a neon lamp. The disc turns in synchronism with the transmitter and the neon lamp stands behind the disc. It is modulated by the received signals and the image becomes visible.





Above: Chief Engineer Graff of the Rocky Point Station of the Radio Corporation of America beside the bank of huge rectifier tubes used in connection with the new R. C. A. Radio Beam Transmitter. This is the newest and most efficient radio beam system of communication yet devised.



Right: Five distinguished figures in the electrical world. Left to right: Dr. E. W. Rice, former president of General Electric; Dr. E. A. Sperry, of the Sperry Gyroscope company, inventor of the gyroscopic compass and gyroscopic stabilator; Dr. C. F. Brush, inventor of the Brush arc light dynamo and electric storage battery; Dr. E. J. Sprague, of General Electric, inventor of arc light, trolley and motor systems; and Dr. Elihu Thomson, of General Electric, inventor of electric welding; co-inventor of the Thomson-Houston arc light system.